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COMPONENT CONVEYING MECHANISM, COMPONENT TAKE-IN MECHANISM, AND COMPONENT SEPARATING MECHANISM FOR CHIP COMPONENT SUPPLYING DEVICE

[Tippu buhin kyokyu sochi no buhin hanso kiko, buhin torikomi kiko oyobi buhin bunri kiko]

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[Claim(s)] /2[*]

[Claim 1] A component conveying mechanism for a chip component supplying device that conveys chip components through a passage;

said component conveying mechanism for a chip component supplying device characterized by being equipped with a fluid unit capable of taking in and discharging a fluid by the exertion of an external force, and performing conveyance of components in the passage by utilizing an intake pressure or discharge pressure of said fluid unit.

[Claim 2] The component conveying mechanism for a chip component supplying device of Claim 1 characterized by the aforesaid fluid unit being a tank having elasticity.

[Claim 3] The component conveying mechanism for a chip component supplying device of Claim 1 characterized by the aforesaid fluid unit being a cylinder.

[Claim 4] The component conveying mechanism for a chip component supplying device of any one of Claims 1 to 3 characterized by the fluid being a vapor, and the conveyance of component being carried out by acting an intake pressure or discharge pressure thereof directly on the chip components in the passage.

[Claim 5] The component conveying mechanism for a chip component supplying device of any one of Claims 1 to 3 characterized by the aforesaid fluid being a vapor or a liquid, and a conveying member being actuated via a fluid actuator in response to the intake pressure or discharge pressure thereof.

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[*] Claim and paragraph numbers correspond to those in the foreign text.

[Claim 6] A component take-in mechanism for a chip component supplying device which separates the components one by one in a chute by stirring chip components stored in a bulk state inside a storage chamber;

said component take-in mechanism for a chip component supplying device characterized by being equipped with a fluid unit capable of intaking and discharging a fluid by the exertion of an external force, and performing stirring of the components inside the storage chamber by utilizing the intake pressure or discharge pressure of said fluid unit.

[Claim 7] The component take-in mechanism for a chip component supplying device of Claim 6 characterized by the aforesaid fluid unit being a tank having elasticity.

[Claim 8] The component take-in mechanism for a chip component supplying device of Claim 6 characterized by the aforesaid fluid unit being a cylinder.

[Claim 9] The component take-in mechanism for a chip component supplying device of any one of Claims 6 to 8 characterized by the fluid being a vapor, and the stirring of components being carried out by acting an intake pressure or discharge pressure thereof directly on the chip components in the storage chamber.

[Claim 10] The component take-in mechanism for a chip component supplying device of any one of Claims 6 to 8 characterized by the aforesaid fluid being a vapor or a liquid, and stirring of components being carried out by actuating a stirring member via a fluid actuator in response to the intake pressure or discharge pressure thereof.

[Claim 11] A component separating mechanism for a chip component supplying device, which separates, from the succeeding chip components, the leading chip to be taken out from among the chip components conveyed along the passage;

said component separating mechanism for a chip component supplying device characterized by being equipped with a fluid unit capable of intaking and discharging a fluid by the exertion of an external force, and performing separation of the leading chip component by utilizing the intake pressure or discharge pressure of said fluid unit.

[Claim 12] The component separating mechanism for a chip component supplying device of Claim 11 characterized by the aforesaid fluid unit being a tank having elasticity.

[Claim 13] The component separating mechanism for a chip component supplying device of Claim 11 characterized by the aforesaid fluid unit being a cylinder.

[Claim 14] The component separating mechanism for a chip component supplying device of any one of Claims 11 to 13 characterized by the fluid being a vapor, and the conveyance of component being carried out by acting an intake pressure or discharge pressure thereof directly on the leading chip component in the passage.

[Claim 15] The component separating mechanism for a chip component supplying device of any one of Claims 11 to 13 characterized by the aforesaid fluid being a vapor or a liquid, and a separating member being actuated via a fluid actuator in response to the intake pressure or discharge pressure thereof.

[Detailed Specifications]

[0001]

[Technical Field of the Invention] The present invention relates to a component conveying mechanism for a chip component supplying device for conveying chip components along a passage, a component take-in mechanism for a chip component supplying device for which intaking chip components one by one by stirring the chip components stored in a bulk state inside a storage chamber, and a component separating mechanism for a chip component supplying device for separating, from succeeding chip components, a leading chip component to be taken out from among the chip components conveyed in the passage.

[0002]

[Prior Art] A publication disclosing this kind of chip component supplying device includes Tokukai JP-A No. H6-232596.

[0003] The component conveying mechanism shown in this publication is equipped with an endless belt for conveying chip components, a ratchet mechanism, which intermittently moves the belt, and a lever mechanism, which drives the ratchet mechanism. This component conveying mechanism performs conveyance of the chip components by actuating the ratchet mechanism via this lever mechanism, and intermittently moving the belt in response to the actuation of this ratchet mechanism upon pushing of a control portion of the lever mechanism.

[0004] Moreover, the component take-in mechanism shown in this publication is equipped with a storage chamber, which stores the chip components in a bulk state, a conveyance pipe through which the chip components are taken in and guided downward, an intake pipe arranged movably vertically on the outer side of the conveyance pipe, and a lever mechanism, which moves the intake pipe up/down. This component take-in mechanism takes in components one by one into this storage chamber through an upper end opening of the conveyance pipe upon pushing of the control portion of the lever mechanism by moving an intake pipe up/down via this lever mechanism and performing stirring of the components inside the storage chamber in response to the up/down movement of this intake pipe.

[0005] Furthermore, the component separating device shown in this publication is equipped with an endless belt for conveying the chip component, a movable stopper arranged at a prescribed position on a belt, and a lever mechanism that moves the stopper back and forth. Upon pushing of the control portion of the lever mechanism, this component separating device moves the stopper situated at a component stopping position forward via this lever mechanism and pulls it apart from the leading chip component to be taken out. Moreover, the component separating mechanism shown in this publication separates the stopper from the leading chip component, whereby the leading chip component can be separated from the succeeding chip components.

[0006]

[Problems to be Solved by the Invention] In the aforesaid conventional device, the component conveying mechanism, component take-in mechanism, and component separating mechanism are respectively driven directly by the lever mechanism; hence, there are inconveniences because the structure of the lever mechanism becomes complicated with ease, and moreover, the existence of this lever mechanism is a restriction and hindrance from a design standpoint.

[0007] The present invention was accomplished in view of the aforesaid circumstances, and it is an object thereof to provide a component conveying mechanism, component take-in mechanism, and component separating device for a chip component supplying device, wherein the respective component conveying mechanism, component take-in mechanism, and component separating mechanism can be constructed compactly, and also, a high flexibility in design can be ensured.

[0008]

[Means for Solving the Problems] In order to achieve the aforesaid object, the invention pertaining to the component conveying mechanism (Claim 1) is characterized by being equipped with a fluid unit capable of taking in and discharging a fluid by the exertion of an external force, and performing conveyance of components in the passage by utilizing an intake pressure or discharge pressure of said fluid unit. Since this component conveying mechanism performs conveyance of components in the passage merely by the exertion of an external force on the fluid unit, a complicated lever mechanism, as with the conventional device, is not required. Moreover, since a fluid piping is performed freely, the existence of the fluid unit is not a restriction or hindrance from a design standpoint.

[0009] Moreover, the invention pertaining to the component take-in mechanism (Claim 6) is mainly characterized by being equipped with a fluid unit capable of intaking and discharging a fluid by the exertion of an external force, and performing stirring of the components inside the storage chamber by utilizing the intake pressure or discharge pressure of said fluid unit. Since this component take-in mechanism takes in the chip components into the chute one by one by stirring the components inside the storage chamber merely by exerting an external force on the fluid unit, a complicated lever mechanism, as with the conventional device, is not required. Moreover, since a fluid piping is performed freely, the existence of the fluid unit is not a restriction or hindrance from a design standpoint.

[0010] Furthermore, the invention pertaining to the component separating mechanism (Claim 11) is mainly characterized by being equipped with a fluid unit capable of intaking and discharging a fluid by the exertion of an external force, and performing separation of the leading chip component by utilizing the intake pressure or discharge pressure of said fluid unit. Since the leading chip component to be taken out can be separated from the succeeding chip component by this component separating device merely by exerting an external force on the fluid unit, a complicated lever mechanism, as with the conventional device, is not required. Moreover, since the fluid piping is performed freely, the existence of the fluid unit is not a restriction or a hindrance from a design standpoint.

[0011]

[Embodiments of the Invention] [1st Embodiment] An embodiment in which conveyance of components is performed by acting the discharge pressure of the air tank on the chip component directly is shown in Figure 1. 1 in the drawing is a frame; 2 is a hopper; 3 is a chute pipe; 4 is a component guide; 5 is an air tank; 6 is a tank support member; 7 is an operation lever; and AN is a suction nozzle for taking out a component.

[0012] The hopper 2 is equipped with a storage chamber 2a, a freely opening/closing cover 2b, which covers the opening at the upper end of the storage chamber 2a, and a through-hole 2c formed in the bottom surface of the storage chamber 2a, and this hopper is attached to the frame 1 to freely detach. A large number of one kind of a chip component P having a prismatic shape or a columnar shape, e.g., a chip component P represented by a chip capacitor, chip resistor, chip inductor, or the like are stored inside the storage chamber 2a in a bulk state.

[0013] The chute pipe 3 comprises a metal pipe material or hard resin pipe material having a prescribed length. The lower end of this chute pipe 3 is secured to the component guide 4, and the upper end thereof is arranged to pass through the aforesaid hole 2c vertically, in a positional relationship such that the upper end thereof is slightly higher than the upper end of the hole 2c. The thickness of this chute pipe 3 is less than the maximum length of the end faces of the chip components P to be supplied, and moreover, the cross-sectional shape of the inner hole is a shape similar to and slightly larger than that of the end faces of the chip components P to be supplied.

[0014] The component guide 4 is equipped with a curved passage 4a communicated with the inner hole of the aforesaid chute pipe 3, and a linear passage 4b connected in the sideways direction to this curved passage 4a, and it is attached to the frame 1 to freely detach. The cross-sectional shape of this curved passage 4a and linear passage 4b match the cross-sectional shape of the inner hole of the chute pipe 3. In addition, at the front end of the linear passage 4b are provided a stopper portion 4c that stops the chip component P being aligned and conveyed along this linear passage 4b, and a component take-out hole 4d through which the leading chip component P stopped by this stopper portion 4c is exposed. Furthermore, a ventilation passage 4e leading to the tail end of the linear passage 4b from the rear wall of the component guide 4 is formed at the rear of the component guide 4, and a tube connection tool TC is attached to the guide rear wall part of this ventilation passage 4e.

[0015] The air tank 5 comprises a synthetic rubber, such as SBR or silicone, as shown in Figure 2 as an exterior perspective view thereof, and it has a hollow interior and moderate elasticity. Moreover, a discharge port 5a is formed at the right end portion of the air tank 5, and a valve plate VP, which covers this discharge port 5a to freely open/close is provided on the outer side of the discharge port 5a. Furthermore, an intake port 5b is formed at the left end portion of the air tank 5, and a normally-closed valve plate VP, which covers this intake port 5b to freely open/close, is provided on the inside of the intake port 5b. Each valve plate VP comprises a thin resin plate or the like having resiliency, and one part thereof is immovably attached to the air tank 5, and opening/closing of the discharge port 5a and the intake port 5b are performed at another rockable part.

[0016] The tank support member 6 is formed with a bottomed tube shape from a metal or hard resin, and it is fitted in an airtight manner to the discharge port 5a and intake port 5b of the aforesaid air tank 5, respectively. The aforesaid air tank 5 is attached to the upper surface of the component guide 4 in a state where two tank support members 6 were fitted. Moreover, a ventilation hole 6a is formed in each tank support member 6, and in the illustrated example, the tube connection tool TC is attached to the ventilation hole 6a on the discharge port 5a side. This tube connection tool TC and another tube connection tool TC provided in the ventilation passage 4e of the aforesaid component guide 4 are connected by a resilient air tube (not shown).

[0017] One end of the operation lever 7 is attached to the frame 1 to freely turn via an axial pin AP. Moreover, a coil spring SS is mounted to the axial pin AP, the operation lever 7 is urged in a clockwise direction by a biasing force of the coil spring SS to keep its normal position horizontally. Furthermore, a spherical pushing portion 7a for pushing and deforming the air tank 5 is provided on the operation lever 7.

[0018] The operation of the device shown in Figure 1 will now be described with reference to Figures 3 and 4. As shown in Figure 1, the chip components P in the storage chamber 2a are taken into the upper end opening of the chute tube 3 one by one in its longitudinal direction by receiving vibration from a vibration generator (not shown), and are moved in the chute tube 3 by their own weight while maintaining the longitudinal direction, and enter into the lower curved passage 4a. In the course of the chip components P that entered into the curved passage 4a passing through this curved passage 4a, the energization of the chip components changes from the vertical direction to the horizontal direction at an angle of about 90 degrees. After the energization is changed, the chip components P enter the linear passage 4b.

[0019] In this state, if the movable end of the operation lever 7 is pushed in a direction of the outline arrow as shown in Figure 3, the operation lever 7 turns in a counterclockwise direction against the biasing force of the coil spring SS, and the air tank 5 is crushed by the pushing portion 7a of the operation lever 7. With this operation, the valve plate VP is opened by the discharge pressure from the discharge port 5a of the air tank 5, and the discharged air is sent to the ventilation passage 4e of the component guide 4 through an air tube (not shown). The air sent to the ventilation passage 4e is discharged forward from the tail end of the linear passage 4b, and the chip components P in the linear passage 4b are pushed and conveyed forward by the discharge pressure (positive pressure). The chip components P conveyed forward in their arranged state are stopped when the leading chip component thereof abuts the stopper 4c.

[0020] After this, as shown in Figure 4, if the pushing force against the movable end of the operation lever 7 is released, the operation lever 7 is returned to its original position by the urging force of the coil spring SS, and the air tank 5 is simultaneously restored in its original shape by its own an elasticity property. During the course of the restoration of the air tank 5 to its original shape, the valve plate VP is opened by the intake pressure produced at the intake port 5b, and air enters into the air tank 5 from the outside. At that time, since the valve plate VP at the side of the discharge port 5a is, of course, closed, intake pressure (negative pressure) should not act on the opening of the ventilation passage 4e on the linear passage 4b side.

[0021] As such, according to the chip component supply mechanism of the 1st embodiment, the discharge pressure (positive pressure) when the air tank 5 is crushed is directly applied to the chip components P in the linear passage 4b, whereby the components can be conveyed in the linear passage 4b. That is, since the components can be conveyed in the linear passage 4b merely by exerting the pushing force on the air tank 5, a complicated lever mechanism, as with the conventional device, becomes unnecessary, and the component transfer mechanism can be constructed compactly. Moreover, piping for air can be freely performed, and a high flexibility in design can be ensured without the existence of the air tank 5 being a restriction or hindrance from a design standpoint.

[0022] Moreover, the valve plate VP provided on the air tank 5 may be replaced by a valve structure, such as a check valve comprising a spring-biased valve and valve seat.

[0023] Moreover, as shown in Figure 5, if a ventilation hole 2d is formed from the inferior surface of the hopper 2 to the bottom surface of the storage chamber 2a, and preferably, in the vicinity of the upper end of the chute tube 3, and if the tube connection tool TC is attached to the lower end of the ventilation hole 2d at the hopper wall part, and this tube connection tool TC and another tube connection tool TC provided at the ventilation hole 6a on the discharge port 5a side of the air tank 5 are connected to each other by an air tube (not shown), the discharge pressure (positive pressure) when the air tank 5 is crushed by the operation lever 7 acts directly on the chip components P in the storage chamber 2a to stir the chip components inside the storage chamber 2a, and the chip components P inside this storage chamber 2a can be taken one by one into the upper end opening of the chute tube 3. That is, since the chip components P inside the storage chamber 2a are stirred and the chip components P can be taken into the upper end opening of the chute tube 3 one by one merely by exerting a pushing force acting on the air tank 5, a complicated lever mechanism, as in the conventional device, becomes unnecessary, and the component take-in mechanism can be constructed compactly. In addition, because air piping can be freely performed, the design flexibility can be ensured without the existence of the air tank 5 being a restriction or hindrance from a design standpoint.

[0024] Furthermore, as shown in Figure 6(A), if a recess 4f for taking in the leading chip component P in the linear passage 4a is formed at its side part corresponding to the leading chip component P, a ventilation passage 4g is formed in the recess 4f and a tube connection tool TC is connected to this ventilation hole, while another tube connection tool (not shown) is provided at the ventilation hole 6a on the intake port 5b side of the air tank 5, and both the tube connection tools are connected by an air tube (not shown), the intake pressure (negative pressure) generated when the air tank 5 returns to its original shape is applied to the opening of the ventilation passage 4g on the recess 4f side, whereby the leading chip component P can be separated from the 2nd chip component P by drawing the leading chip component, which was stopped by the stopper 4c, into the recess 4f. That is, since the leading chip component P to be taken out can be separated from the succeeding chip components P merely by releasing the pushing force acting on the air tank 5, a complicated lever mechanism, as with the conventional device, becomes unnecessary, and the component separating mechanism can be constructed compactly. Moreover, air piping can be freely performed, high flexibility in design can be ensured without the existence of the air tank 5 being a restriction or hindrance from a design standpoint.

[0025] Further yet, as shown in Figure 6(B), if the linear passage 4a is provided on its side part corresponding to a 2nd chip component P with a ventilation passage 4h, a tube connection tool TC is attached to this ventilation passage, while a tube connection tool is provided on the tank support member 6 on the intake port 5b side of the air tank 5, and both the tube connection tools are connected by an air tube (not shown), the intake pressure (negative pressure) generated when the air tank 5 is restored in its original shape acts on the opening of the ventilation passage 4h on the linear passage 4a side, and the 2nd chip component P can be attracted to and held on the side surface of the linear passage 4a. That is, since the 2nd chip component P can be maintained at the same position merely by releasing the pushing force acting on the air tank 5, when the leading component P is taken out by the suction nozzle AN, the 2nd chip component P is not pulled out therewith, or inclined. In addition, if this succeeding component holding mechanism is used in combination with the component separating mechanism shown in Figure 6(A), it is possible to take out the leading chip component P to be taken out in a stable state without interfering with the 2nd chip component P.

[0026] Still further, the air tank 5 and the tank holding members 6 may be deleted from the device in Figure 1, and the air cylinder 8 shown in Figure 7 may be used instead. This air cylinder 8 has a cylinder tube 8a equipped with a discharge port 8b and an intake port 8c. A cap 9 having a ventilation hole 9a is air-tightly fitted to the intake port 8c. A tube connection tool TC is attached to the discharge port 8c. Moreover, the ventilation hole 9a of the cap 9 is provided at its inner side with a normally-closed valve plate VP for feely opening/closing the ventilation hole 9a. This tube connection tool TC and another tube connection tool TC provided at the ventilation passage 4e of the component guide 4 are connected by an air tube (not shown). Furthermore, a piston 8d is movably arranged inside the cylinder tube 8a in an airtight state. A rod 8e equipped with a spherical head portion is coupled to the piston 8d and is projected outward from the cylinder tube 8a. A coil spring CS for upwardly biasing the piston 8d is arranged in the cylinder tube 8a.

[0027] As shown in Figure 7, if the movable end of the operation lever 7 is pushed in the direction of the arrow, the operation lever 7 is turned in the counterclockwise direction against the biasing force of the coil spring SS, and the rod 8e and the piston 8d of the air cylinder 8 are moved downward against the biasing force of the coil spring CS. Accordingly, air discharged from the discharge port 8b of the air cylinder 8 is sent into the ventilation passage 4e of the component guide 4 through the air tube (not shown). The air sent to the ventilation passage 4e is discharged forwardly from the rear end of the linear passage 4b. The chip components P in the linear passage 4b are pushed and conveyed forward by the discharge pressure (positive pressure) at this time.

[0028] As shown in Figure 8, if the pushing force against the movable end of the operation lever 7 is released, this operation lever 7 returns to its original position by the urging force of the coil spring SS, and the rod 8e and the piston 8d of the air cylinder 8 simultaneously return to their original positions by the biasing force of the coil spring CS. During the course of the piston 8d returning to its original position, the valve plate VP is opened by the intake pressure generated at the intake port 8c, and air enters into the cylinder tube 8a from the outside. In the illustrated example, since the caliber of the tube connection tool TC attached to the discharge port 8b is smaller than that of the intake port 8c, a large intake pressure (negative pressure) does not act on the opening of the ventilation passage 4e on the linear passage 4b side during the course of the piston 8d returning to its original position. If another valve plate VP, which is the same as that described above, is provided on the discharge port 8b side, and the tube connection tool is attached to the valve plate via a cap, it is of course possible to prevent the intake pressure (negative pressure) from acting on the opening of the ventilation passage 4e on the linear passage 4b side during the course of the piston 8d returning to its original position.

[0029] [2nd Embodiment] Figure 9 shows an embodiment in which an intake pressure of an air tank is acted directly onto chip components to convey the chip components. In this drawing, the reference code 11 is a frame, 12 is a hopper, 13 is a chute tube, 14 is a component guide, 15 is an air bag, 16 is tank holding members, 17 is an operation lever, and AN is a suction nozzle.

[0030] The hopper 12 is equipped with a storage chamber 12a, a lid 12b which covers an upper end opening of the storage chamber 12a to freely open, and a through-hole 12c formed in the bottom surface of the storage chamber 12a. The hopper is detachably attached to the frame 11. A large number of one kind of prismatic or cylindrical chip component P represented by, e.g., a chip component P represented by a chip capacitor, chip resistor, or chip inductor are stored in the storage chamber 12a in a bulk state.

[0031] The chute tube 13 comprises metal pipe or hard resin pipe having a prescribed length. The lower end of the chute tube 13 is secured to the component guide 14, and the upper end thereof is vertically inserted and arranged in the through-hole 12c in a positional relationship such that the upper end of the chute tube is slightly higher than the upper end of the aforesaid through-hole 12c. The thickness of this chute tube 13 is smaller than the maximum length of the end faces of the chip components P to be supplied, and further, the cross-sectional shape of the inner hole of the chute tube is a similar shape to and slightly larger than that of the end faces of the chip components P to be supplied.

[0032] The component guide 14 is equipped with a curved passage 14a communicating with the inner hole of the aforesaid chute tube 13, and a horizontal linear passage 14b continued to this curved passage

14a, and it is detachably attached to the frame 11. The cross-sectional shape of each of the curved passage 14a and the linear passage 14b matches the cross-sectional shape of the inner hole of the chute tube 13. In addition, the linear passage 14b is provided at its front end portion with a stopper portion 14c for stopping the chip component P, which is arranged and conveyed along the linear passage 14b, and a component taking out port 14d for exposing the leading chip component P that is stopped by this stopper portion 14c. Furthermore, the stopper portion 14c is formed with a ventilation passage 14e extending from the front wall of the component guide 14 to the front end of the linear passage 14b, and a tube connection tool TC is attached to the front guide wall part of this ventilation passage 14e.

[0033] The air tank 15 comprises a synthetic rubber, such as SBR and silicone, as is shown in Figure 2, and is hollow and has moderate elasticity. Moreover, this air tank 15 is formed at its right end portion with a discharge port 15a, and the discharge port 15a is provided on the outside with a normally-closed valve plate VP for freely opening/closing the discharge port 15a. Also, the air tank 15 is formed, at its left end portion, with an intake port 15b, and the intake port 15b is provided at its inside with a normally-closed valve plate VP for freely opening/closing the intake port 15b. Each of the valve plates VP comprises a thin resin thin plate having flexibility. A portion of the valve plate is immovably attached to the tank 15, and opening/closing of the discharge port 15a and intake port 15b is performed at other rockable parts of the valve plate.

[0034] The tank holding members 16 are formed from metal or hard resin into a bottomed cylindrical shape, and they are fitted in an airtight manner to the discharge port 15a and the intake port 15b of the aforesaid air tank 15. The aforesaid air tank 15 is attached to the upper surface of the component guide 14 in a state where two tank holding members 16 are fitted. Each of the tank holding members 16 is formed with a ventilation hole 16a, and in the illustrated example, a tube connection tool TC is attached to the ventilation hole 16a on the intake port 15b side. This tube connection tool TC and a tube connection tool TC provided at the ventilation passage 14e of the component guide 14 are connected by a flexible air tube (not shown).

[0035] One end of the operation lever 17 is turnably attached to the frame 11 via the axial pin AP. A coil spring SS is mounted to the axial pin AP, the operation lever 17 is urged in a clockwise direction by a biasing force of the coil spring SS to keep the horizontal state as its normal position. Furthermore, the operation lever 17 is provided with a spherical pushing portion 17a for pushing and deforming the aforesaid air tank 15.

[0036] The operation of the device shown in Figure 9 will now be described with reference to Figures 10 and 11. As shown in Figure 9, the chip components P in the storage chamber 2a [sic] are taken into the upper end opening of the chute tube 13 one by one in its longitudinal direction by receiving vibration from a vibration generator (not shown) or the like, and are moved in the chute tube 13 by their own weight as is in the longitudinal direction and enter into the lower curved passage 14a. The energization of the chip components P entering the curved passage 14a changes about 90 degrees from the vertical direction to the horizontal direction during the course of passing through this curved passage 14a. After the energization direction is changed, the chip components P enter the linear passage 14b.

[0037] In this state, if the movable end of the operation lever 17 is pushed in the direction of the outline arrow, as shown in Figure 10, the operation lever 17 is turned in a counterclockwise direction against the biasing force of the coil spring SS, and the air tank 15 is crushed by the pushing portion 17a of the operation lever 17. At this time, the valve plate VP is opened by the discharge pressure from the discharge port 5a [sic] of the air bag 5 [sic], and the air to be discharged is discharged to the outside.

[0038] After this, as shown in Figure 4, if the pushing force against the movable end of the operation lever 17 is released, the operation lever 17 is returned to its original position by the biasing force of the coil spring SS, and the air tank 15 is simultaneously returned to its original shape by its own elasticity. During the course of the air tank 15 returning to its original shape, the valve plate VP is opened by the intake pressure (negative pressure) produced at the intake port 15b, the same intake pressure (negative pressure) is acted on the opening of the ventilation passage 14e on the linear passage 4b side, and the chip components P in the linear passage 14b are drawn are drawn by the intake pressure (negative pressure) and are conveyed forward. The chip components P conveyed forward in their arranged state are stopped when the leading chip component abuts against the stopper portion 14c.

[0039] As such, according to the chip component supply mechanism of the 2nd embodiment, the intake pressure (negative pressure) generated when the air tank 15 returns to its original shape is directly acted on the chip components P in the linear passage 4b, and the components can be conveyed in the linear passage 4b. That is, since the components can be conveyed in the linear passage 4b merely by releasing the pushing force acting on the air tank 15, a complicated lever mechanism, as with the conventional device becomes unnecessary, and the component conveying mechanism can be constructed compactly. In addition, air piping can be freely designed, without the existence of the air tank 15 being restriction or hindrance from a design standpoint, and high flexibility in design can be ensured.

[0040] Moreover, a valve structure, such as a check valve comprising a spring-biased valve and a valve seat, may be used instead of the valve plate VP provided on the air tank 15.

[0041] Furthermore, as shown in Figure 12, if a ventilation passage 12d is formed from the inferior surface of the hopper 12 to a bottom surface of the storage chamber 12a, and preferably, in the vicinity of the upper end of the chute tube 13, a tube connection tool TC is attached to the lower hopper wall part of the ventilation passage 12d, and also, a tube connection tool TC is attached to the ventilation hole 16a on the discharge port 15a side of the air tank 15, and both tube connection tools TC are connected by an air tube (not shown), the discharge pressure (positive pressure) when the air tank 15 is crushed by the operation lever 17 acts directly on the chip components P in the storage chamber 12a to stir the components in the storage chamber 12a, and the chip components P inside this storage chamber 12a can be taken one by one into the upper end opening of the chute tube 13. That is, since the components in the storage chamber 12a are stirred and the chip components P can be taken into the upper end opening of the chute tube 13 one by one merely by exerting a pushing force on the air tank 15, a complicated lever mechanism, as with the conventional device becomes unnecessary, and the component take-in mechanism can be constructed compactly. Also, air piping can be freely performed, without the existence the air tank 15 being a restriction or hindrance in terms of design, and high flexibility in design can be ensured.

[0042] Furthermore, as shown in Figure 13(A), if the linear passage 4a is provided at its side part corresponding to the leading chip component P with a recess 14f for taking in the leading chip component P, a ventilation passage 14g is provided in a part corresponding to the recess 14f, a tube connection tool TC is attached to this, another tube connection tool (not shown) is provided to a ventilation hole 16a on the discharge port 15a side of the air tank 15, and both the tube connection tools are connected by an air tube (not shown), the discharge pressure (positive pressure) when the air tank 15 is crushed is acted on the opening of the ventilation passage 14g on the recess 14f side, thereby pushing the leading chip component P, which was stopped by the stopper portion 4c, into the recess 14f, and the leading chip component can be separated from the 2nd chip component P. That is, since the leading chip component P to be taken out can be separated from the succeeding chip components P merely by exerting the pushing force acting on the air tank 15, a complicated lever mechanism, as with the conventional device becomes unnecessary, and the component separating mechanism can be constructed compactly. Furthermore, air piping can be freely performed, without the existence of the air tank 15 being a restriction or hindrance from a design standpoint, and high flexibility in design can be ensured.

[0043] Furthermore, as shown in Figure 13(B), if the linear passage 14a is provided at its side part corresponding to a 2nd chip component P with a ventilation passage 14h, a tube connection tool TC is attached to this, and also, another tube connection tool (not shown) is provided at a ventilation hole 16a on the intake port 15b side of the air tank 15, and both the tube connection tools are connected by an air tube (not shown), the discharge pressure (positive pressure) when the air tank 15 is crushed is exerted on the opening on the linear passage 14a side of the ventilation hole 14h, whereby the 2nd chip component P can be attracted to and held by a side of the linear passage 14a. That is, since the 2nd chip component P can be held at the same position merely by exerting the pushing force on the air tank 15, when the leading component P is taken out by the suction nozzle AN, the 2nd chip component P is not pulled out therewith or inclined. Moreover, if this mechanism is used in combination with the component separating mechanism shown in Figure 13(A), the chip component P to be taken out can be taken out in a stabilized state without interference with the 2nd chip component P.

[0044] Still further, the air tank 15 and the tank holding members 16 may be deleted from the device shown in Figure 9, and an air cylinder 18, as shown in Figure 14, may be used in their place. The air cylinder 18 has a cylinder tube 18a equipped with a discharge port 18b and an intake port 18c. A cap 19 having a ventilation hole 19a is fitted in an airtight manner to the intake port 18c and a tube connection tool TC is attached to the ventilation hole 19a. This tube connection tool TC and another tube connection tool TC provided at the ventilation passage 14e of the component guide 14 are connected by an air tube (not shown). Moreover, a normally-closed valve plate VP, which covers the ventilation hole 9a to freely open/close, is provided on the inner side of the ventilation hole 9a of the cap 9, and another normally-closed valve plate VP, which covers the discharge port 18b to freely open/close, is provided on the discharge port 18b. Furthermore, a piston 18d is movably arranged in the cylinder tube 18a in an airtight manner, a rod 18e equipped with a spherical head portion is coupled to the piston 18d and is projected outward from the cylinder tube 18a. Further yet, a coil spring CS for upwardly biasing the piston 18d is arranged in the cylinder tube 18a.

[0045] As shown in Figure 14, if the movable end of the operation lever 17 is pushed in the direction of the outline arrow, the operation lever 17 is turned in the counterclockwise direction against the biasing force of the coil spring SS, and the rod 18e and the piston 18d of the air cylinder 18 are moved downward against the biasing force of the coil spring CS. At this time, the valve plate VP is opened by the discharge pressure from the discharge port 18b of the air cylinder 18, and air to be discharged is discharged to the outside.

[0046] After this, if the pushing force against the movable end of the operation lever 17 is released, as shown in Figure 15, the operation lever 17 returns to its original position by the biasing force of the coil spring SS, and at the same time, the rod 18e and the piston 18d of the air cylinder 18 return to their original positions by the biasing force of the coil spring CS. During the course of the piston 18d returning to its original position, the valve plate VP is opened by the intake pressure generated at the intake port 18c, the same intake pressure (negative pressure) acts on the opening of the ventilation passage 14e on the linear passage 4b side, and the chip components P in the linear passage 4b are drawn by the intake pressure (negative pressure) at this time, and are conveyed forward.

[0047] [3rd Embodiment] An embodiment in which components are conveyed by actuating a conveying member via an air actuator by a discharge pressure of an air tank is shown in Figure 16. 21 in the drawing is a frame; 22 is a hopper; 23 is a chute tube; 24 is a stirring member; 25 is a component guide; 26 is an air tank; 27 is tank holding members; 28 is an air cylinder for conveying components; 29 is an air cylinder for stirring components; 30 is an operation lever; and AN is a suction nozzle for taking out components.

[0048] The hopper 22 is equipped with a storage chamber 22a, a lid 22b, which covers the upper end opening of the storage chamber 22a to freely open, and a through-hole 22c formed in the bottom surface of the storage chamber 22a, and is detachably attached to the frame 21. A large number of one kind of prismatic or cylindrical chip component P, e.g., a chip component P represented by a chip capacitor, chip resistor, or chip inductor are stored in the storage chamber 22a in a bulk state.

[0049] The chute tube 23 comprises a metal pipe or hard resin pipe having a prescribed length. The lower end of this chute tube 23 is secured to the component guide 24, and the upper end thereof is vertically inserted and arranged at the center of the through-hole 22c so that it is slightly higher than the upper end of the aforesaid through-hole 22c. The thickness of the chute tube 23 is smaller than the maximum length of the end faces of the chip components P to be supplied, and moreover, the cross-sectional shape of the inner hole of the chute tube is a similar shape to and slightly larger than the shape of the end faces of the chip components P to be supplied.

[0050] The stirring member 24 comprises a metal pipe or hard resin pipe having a prescribed length, with its external form being slightly smaller than the a through-hole 22c, and its internal form being slightly larger then the aforesaid chute tube 22. The stirring member 24 is arranged vertically movably between the through-hole 22c and the chute tube 23 in a positional relationship in which the upper end of this stirring member is slightly lower than an upper end of the through-hole 22c in a lowered state of the stirring member. The thickness of this stirring member 24 is larger than the maximum length of the end faces of the chip components P to be supplied. Moreover, the stirring member 24 is provided at its upper end with a conical guide face 24a, and further, at the lower end of the stirring member 24 is provided a flange 24b. A coil spring CS is stretched between this flange 24b and the inferior surface of the hopper 22.

[0051] The component guide 25 is equipped with a curved passage 25a communicated to the inner hole of the chute tube 23, and a horizontal linear passage 25b continued to the curved passage 25a, and is detachably attached to the frame 21. The cross-sectional shape of each of the curved passage 25a and the linear passage 25b matches the cross-sectional shape of the inner hole of the chute tube 23. Moreover, the linear passage 25b is provided at its front end with a stopper portion 25c for stopping the chip components P, which are arranged and conveyed along the linear passage 25b, and a component take-out port 25d for exposing the leading chip component P, which is stopped by the stopper 25c. Furthermore, the component guide 25 is formed at its rear portion with a through-hole 25e extending from the rear wall of the component guide to the tail end of the linear passage 4b.

[0052] The air tank 26 comprises a synthetic rubber, such as SBR and silicone, as shown in Figure 17, and is hollow and has moderate elasticity. In addition, the air tank 26 has formed at its right end portion a ventilation port 26a for taking in and discharging air. This air tank 26 performs intake and exhausting of air by a compressive deformation and elastic returning ability on its own, but a spring member may be provided internally to assist with the air intake by the elastic returning ability.

[0053] The tank holding members 27 are formed into a bottomed cylindrical shape from a metal or hard resin, and they are fitted to the both end portions of the aforesaid air tank 26. The aforesaid air tank 26 is attached to a top surface of the component guide 25 in a state where the two tank holding members 27 are fitted. Moreover, a ventilation hole 27a is formed in the tank holding member 27 on the ventilation port 26a side, and a tube connection tool TC is attached to this ventilation hole 27a. This tube connection tool TC and other tube connection tools TC provided on a below-described air cylinder 28 for conveying components and on the air cylinder 29 for stirring components are connected by a flexible air tube (not shown).

[0054] The air cylinder 28 for conveying components is equipped with a cylinder tube 28b having two ventilation ports 28a, a piston 28c movably arranged in the cylinder tube 28b in an airtight state, and a rod 28d coupled to the piston 28c, and at tube connector TC is attached to the rear ventilation port 28a. This air cylinder 28 is attached to the component guide 25 in a state where the rod 28d is inserted into the through-hole 25e of the component guide 25. Incidentally, in the illustrated example, the rod 28d itself is used as the component conveying member.

[0055] The air cylinder 29 for stirring components is equipped with a cylinder tube 29b having two ventilation ports 29a, a piston 29c movably arranged inside the cylinder tube 29b in an airtight state, and a rod 29d coupled to the piston 29c, and the tube connection tool TC is mounted to the lower ventilation port 29a. This air cylinder 29 is attached to the component guide 25, and the tip of the rod 29d touches the inferior surface of the stirring member 24.

[0056] One end of the operation lever 30 is turnably attached to the frame 21 via an axial pin AP. In addition, a coil spring SS is mounted to the axial pin AP, and the operation lever 30 is biased in a clockwise direction by the biasing force of the coil spring SS to keep the horizontal state as its normal position. Furthermore, the operation lever 30 is provided with a spherical pushing portion 30a for pushing and deforming the aforesaid air tank 26.

[0057] The operation of the device shown in Figure 16 will now be described with reference to Figures 18 and 19. If the movable end of the operation lever 30 is pushed in the direction of the outline arrow, as shown in Figure 18, this operation lever 30 is turned in the counterclockwise direction against the biasing force of the coil spring SS, and the air tank 26 is crushed by the pushing portion 30a of the operation lever 30. Accordingly, the air discharged from the ventilation port 26a of the air tank 26 is sent to the component transfer air cylinder 28 and the component stirring air cylinder 29 through an air tube (not shown).

[0058] If the air is sent into the component stirring air cylinder 29, the piston 29c and the rod 29d are moved upward, the stirring member 24 is pushed up by the rod 29 to rise against the biasing force of the coil spring CS. Accordingly, the upper end of the stirring member 24 proceeds into the storage chamber 22a and the chip components P are stirred, and with this stirring of the components, the chip components P inside the storage chamber 22a are taken into the upper end opening of the chute tube 23 one by one in the longitudinal direction, and are moved in the chute tube 23 by their own weight as is in the same direction, and enter into the lower curved passage 25a. In the course of the chip components P that entered into the curved passage 25a passing through this curved passage 25a, the energization of the chip components changes from the vertical direction to the horizontal direction at an angle of about 90 degrees. After the energization is changed, the chip components P enter the linear passage 25b.

[0059] On the other hand, if the air is sent to the component conveying air cylinder 28, the piston 28c and the rod 28d are moved leftward. Accordingly, the tip of the rod 28d projects into the linear passage 25b, and the chip components P that entered into the linear passage 25b are pushed by the rod 28d and conveyed forward.

[0060] After this, if the pushing force against the movable end of the operation lever 30 is released, as shown in Figure 19, this operation lever 30 returns to its original position by the biasing force of the coil spring SS, and the air tank 26 simultaneously returns to its original shape by its own elastic force. During the course of the air tank 26 returning to its original shape, the intake pressure (negative pressure) produced at the ventilation portion 26a acts on the component stirring air cylinder 29 through the air tube, the piston 29c and the rod 29d return to their original positions by the intake pressure (negative pressure), and the stirring member 24 is lowered by the biasing force of the coil spring CS and returned to its original position. Similarly, the intake pressure (negative pressure) produced at the ventilation port 26a also acts on the component conveying air cylinder 28 through the air tube, and the piston 28c and the rod 28d return to their original positions by the intake pressure (negative pressure).

[0061] In short, as shown in Figure 1, if the air tank 26 is crushed by the pushing portion 30a of the operation lever 30 just after the leading chip component P is taken out by the suction nozzle AN through the component taking out port 25d, the chip components P inside the storage chamber 22a are stirred by the stirring member 24 and are taken into the chute tube 23 one by one in a prescribed direction, and also, the chip components P which were sent to the linear passage 26b [sic] through the chute tube 23 are pushed by the rod 28 and conveyed forward. The chip components P conveyed forward in their arranged state are stopped when the leading chip component P abuts against the stopper 25c.

[0062] As described above, according to the chip component supply device of the 3rd embodiment, the rod 28d (component conveying member) of the component transfer air cylinder 28 is actuated by the discharge pressure (positive pressure) when the air tank 26 is crushed, and the components in the linear passage 25b can be conveyed. That is, since the components in the linear passage 25b can be conveyed merely by exerting the pushing force on the air tank 26, a complicated lever mechanism, as with the conventional device, becomes unnecessary, and the component transfer mechanism can be constructed compactly. Furthermore, air piping can be freely performed, without the existence of the air tank 26 being a restriction or hindrance from a design standpoint, and high flexibility in design can be ensured.

[0063] In addition, the stirring member 24 is actuated via the component stirring air cylinder 28 by the discharge pressure (positive pressure) when the air tank 26 is crushed, thereby stirring the components in the storage chamber 22a to take the chip components P inside the storage chamber 22a into the upper end opening of the chute tube 23 one by one. That is, since the components in the storage chamber 22a can be stirred and the chip components P can be taken into the upper opening of the chute tube 23 one by one merely by exerting the pushing force on the air tank 25, a complicated lever mechanism, as with the conventional device becomes unnecessary, and the component take-in mechanism can be constructed compactly. Moreover, air piping can be freely performed, without the existence of the air tank 26 being a restriction or hindrance from a design standpoint, and high flexibility in design can be ensured.

[0064] Furthermore, since the air tank 26 having the single ventilation port 26a can be used, the valve plate VP of the air tank 5 shown in Figure 2 becomes unnecessary, and the structure of the air tank itself can be simplified. Moreover, since the air tank 26 and the two air cylinders 28 and 29 can be composed of a closed-circuit, not only a gas other than air, but also a liquid, such as water, can be used as a power transmitting medium. It is of course possible to realize the same operation even when a tightly closed cylinder is used instead of the air tank 26.

[0065] Moreover, the component stirring air cylinder 29 and the component conveying air cylinder 28 may be deleted from the device in Figure 16 and a component stirring air motor 31 and a component conveying air motor 33 may be used instead, as shown in Figure 20. Both the air motors 31 and 33 enable turning in a prescribed direction by sending air into an intake port.

[0066] A tube connection tool TC is attached to an intake port of the component stirring air motor 31, and an eccentric cam 32 is attached to a rotation shaft 31a of the air motor 31 such that the eccentric cam contacts the inferior surface of the stirring member 24. In short, if the rotation shaft 31a of the air motor 31 is turned at a prescribed angle by utilizing the discharge pressure (positive pressure) when the air tank 26 is crushed, the stirring member 24 can rise from the lower position by the eccentric cam 32 which is synchronously turned.

[0067] On the other hand, a turning shaft (not shown) of the component conveying air motor 33 is coupled to one of a pair of front and rear pulleys 35 around which a belt 34 is wound. The inferior surface of the linear passage 25b of the component guide 25 is opened in this case so that the opened inferior surface is closed by the belt 34, and conveyance of the chip components P can be performed by using this belt 33. In short, if the turning shaft of the air motor 33 is turned a prescribed angle by utilizing the discharge pressure (positive pressure) when the air tank 26 is crushed, the belt 33 is rotated and moved by the pulleys 35 which are turned synchronously, and the chip components P on the belt 33 can be conveyed forward.

[0068] [Other Embodiments] Figures 21 to 25 respectively show modified aspects of the component separating mechanism whereby the leading chip component is separated from the succeeding chip components.

[0069] In the component separating mechanism shown in Figure 21, the front end of a linear passage 41a of a component guide 41 is opened and a movable component stopper 42 is provided in front thereof. This component stopper 42 has elongated holes 42a through which guide pins 41b of the component guide 41 are passed so that the component stopper can move forward and backward. The component stopper is biased backward by coil springs CS, and the rear surface of the component stopper is abutted against the front end of the linear passage 41a. Moreover, a magnet M comprising a rare-earth permanent magnet or the like is embedded in a part of the component stopper 42 facing the leading chip component P. Furthermore, an air cylinder 43 actuated by a discharge pressure (positive pressure) of an air tank or an air cylinder is attached to a side of the component guide 41. The air cylinder 43 is equipped with a cylinder tube 43b having two ventilation ports 43a, a piston 43c movably arranged inside the cylinder tube 43b in an airtight state, and a rod 43d coupled to the piston 43c. A tube connection tool TC is attached to the right ventilation port 43a, and the tip of the rod 43d touches the rear surface of the component stopper 42. If a discharge pressure (positive pressure) of the air tank or the air cylinder is acted on the right ventilation port 43a of the air cylinder 43 in the state in Figure 22(A), the piston 43c and the rod 43d are moved leftward, as shown in Figure 22(B), the component stopper 42 is pushed by the rod 43d and moved leftward, and the leading chip component P which is attracted to the magnet M is moved forward together with the component stopper 42, and is separated from the 2nd chip component P.

[0070] The component separating mechanism shown in Figure 22 has a different component stopper configuration from the component separating mechanism shown in Figure 21. One end of this stopper 44 is attached to the front end of the component guide 41 such that this component stopper can rotate about the one end thereof, and the component stopper is biased backward by the coil spring CS and the rear surface of this component stopper is abutted against the front end of the linear passage 41a. If a discharge pressure (positive pressure) of the air tank or air cylinder is acted on the right ventilation port 43a of the air cylinder 43, the piston 43c and the rod 43d move leftward, and the component stopper 44 is turned counterclockwise by the pushing force of the rod 43d, while the leading chip component P attracted to the magnet M is moved forward together with the component stopper 44 and is separated from the 2nd chip component P.

[0071] A component separating mechanism shown in Figure 23 has a different air cylinder configuration from the component separating mechanism shown in Figure 21. This air cylinder 45 is equipped with a cylinder tube 45b having two ventilation ports 45a, a piston 45c movably arranged in an airtight state inside the cylinder tube 45b, and a rod 45d coupled to the piston 45c. A tube connection tool TC is attached to the left ventilation port 45a, and the tip of the rod 45d touches the rear surface of the component stopper 42. If the intake pressure (negative pressure) of the air tank or air cylinder acts on the left ventilation port 45a of the air cylinder 43 in the state in Figure 24(A), the piston 45c and rod 45d are moved leftward against the biasing force of the coil spring CS, as shown in Figure 24(B), the component stopper 42 is pushed by the rod 45d and moved leftward, while the leading chip component P attracted to the magnet M is moved forward together with the component stopper 42 and is separated from the 2nd chip component P.

[0072] A component separating mechanism shown in Figure 24 is obtained by providing the component separating mechanism shown in Figure 21 with an air cylinder for holding the 2nd chip component P. This air cylinder 46 is equipped with a cylinder tube 46b having two ventilation ports 46a, a piston 46c movably arranged inside the cylinder tube 46b in an airtight state, and a rod 46d coupled to the piston 46c. A tube connection tool TC is attached to the upper ventilation port 46a. Moreover, the linear passage 41a is provided at its side part corresponding to the 2nd chip component P of the component guide 41 with a through-hole (having no reference number), and a rod 46d is inserted in this through-hole. If a discharge pressure (positive pressure) of the air tank or air cylinder acts on the ventilation port 43a on the right side the air cylinder 43 and a discharge pressure (positive pressure) acts on the upper ventilation port 46a of the air cylinder 46 in the state in Figure 25(A), the piston 43c and rod 43d are moved forward, as shown in Figure 25(B), and the component stopper 42 is pushed by the rod 43d and moved leftward, and the leading chip component P attracted to the magnet M is moved forward together with the component stopper 42 and is separated from the 2nd chip component P. Simultaneously, the piston 46c and rod 46d are moved downward, and the 2nd chip component P is attracted to and held on the side of the linear passage 4a by the rod 46d projecting into the linear passage 41a.

[0073] A component separating mechanism shown in Figure 25 has the component separating mechanism shown in Figure 23 provided with an air cylinder for holding the 2nd chip component P. This air cylinder 47 is equipped with a cylinder tube 47b having two ventilation ports 47a, a piston 47c movably arranged in an airtight state inside the cylinder tube 47b, and a rod 47d coupled to the piston 47c. A tube connection tool TC is attached to the lower ventilation port 47a. Moreover, the linear passage 41a is provided at its side part corresponding to the 2nd chip component P of the component guide 41 with a through-hole (having no reference number), and a rod 46d is inserted in the through-hole. If an intake pressure (negative pressure) of the air tank or air cylinder acts on the ventilation port 45a on the left side of the air cylinder 45 and to the lower ventilation port 46a [sic] of the air cylinder 47 in the state in Figure 26(A), the piston 45c and rod 45d are moved leftward, as shown in Figure 26(B), and the component stopper 42 is pushed by the rod 45d and moved forward, while the leading chip component P attracted to the magnet M is moved forward together with the component stopper 42, and is separated from the 2nd chip component P. Simultaneously, the piston 47c and rod 47d are moved downward, and the 2nd chip component P is attracted to and held by the side of the linear passage 4a by the rod 47d projecting into the linear passage 41a.

[0074] Figures 26 and 27 show examples of structures using two or more air units, respectively. The one shown in Figure 26 has the same two air tanks 5 used in the 1st embodiment arranged on a component guide 51, while two pushing portions 52a corresponding to the respective air tanks 5 provided on an operation lever 52 that turns about its one end. If the lengths and sizes of the respective pushing portions 52a are different as shown, when the movable end of the operation lever 52 is pushed downward, the crushing timings of the respective air tanks 5 can be made different. The one shown in Figure 28 has the two air tanks 5 used in the 1st embodiment arranged on the component guide 51, while two pushing portions 53a corresponding to the respective air tanks 5 provided at opposite ends of an operation lever 53 that turns about its center. Of course, it is possible to control the timing even if the air tank 26 shown in Figure 17 or an air cylinder is used instead of the air tank 5.

[0075] In short, if two or more air units, such as air tanks or air cylinders, are used, by utilizing the respective air units, it is possible to make the operating timings for the transfer, taking in, and separation of the components described above optionally different, and to reliably obtain a desired operation.

[0076]

[Advantages of the Invention] As described in detail above, according to the present invention, since conveyance of the components in the passage, stirring of the components inside the storage compartment, and separation of the leading chip component from the succeeding chip components are performed by utilizing the intake pressure or discharge pressure of the fluid unit(s), a complicated lever mechanism, as with the conventional device, becomes unnecessary, and the respective mechanisms can be constructed compactly. Moreover, fluid piping can be freely performed, without the existence of the fluid unit being a restriction or hindrance from a design standpoint, and high flexibility in design can be ensured.

[Brief Description of the Drawings]

[Figure 1] A drawing showing a 1st embodiment in which a discharge pressure of an air tank acts directly on chip components to transfer the components.

[Figure 2] A perspective view of the air tank used in the 1st embodiment.

[Figure 3] An explanatory drawing of the actuation of the 1st embodiment.

[Figure 4] An explanatory drawing of the actuation of the 1st embodiment.

[Figure 5] A drawing showing an example in which components are stirred by utilizing the discharge pressure of the air tank.

[Figure 6] A drawing showing an example in which components are separated and an example in which a 2nd component is held by utilizing the intake pressure of the air tank.

[Figure 7] A drawing showing an example in which an air cylinder was used instead of the air tank.

[Figure 8] An explanatory diagram of the actuation in Figure 7.

[Figure 9] A drawing showing a 2nd embodiment in which an intake pressure of an air tank is acted directly on chip components to transfer the components.

[Figure 10] An explanatory diagram of the actuation of the 2nd embodiment.

[Figure 11] An explanatory diagram of the actuation of the 2nd embodiment.

[Figure 12] A drawing showing an example in which components are stirred by utilizing the discharge pressure of the air tank.

[Figure 13] Drawings showing an example in which components are separated by utilizing the discharge pressure of the air tank and an example in which the 2nd component is held.

[Figure 14] A drawing showing an example in which an air cylinder was used instead of an air tank.

[Figure 15] An explanatory diagram of the actuation in Figure 14.

[Figure 16] A drawing showing a 3rd embodiment in which components are conveyed by actuating the conveying member by a discharge pressure of an air tank via the air actuator.

[Figure 17] A perspective view of the air tank used in the 3rd embodiment.

[Figure 18] An explanatory diagram of the actuation of the 3rd embodiment.

[Figure 19] An explanatory diagram of the actuation of the 3rd embodiment.

[Figure 20] A drawing showing an example in which an air motor was used instead of the component stirring air cylinder.

[Figure 21] A drawing showing modified aspects of the component separating mechanism, and an explanatory diagram of the actuation thereof.

[Figure 22] A drawing showing a modified aspect of the component separating mechanism.

[Figure 23] A drawing showing a modified aspect of the component separating mechanism, and an explanatory diagram of the actuation thereof.

[Figure 24] A drawing showing a modified aspect of the 2nd component holding mechanism, and an explanatory diagram of the actuation thereof.

[Figure 25] A drawing showing a modified aspect of the 2nd component holding mechanism, and an explanatory diagram of the actuation thereof.

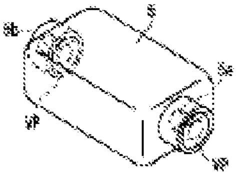
[Figure 26] A drawing showing a configuration example of a case in which two or more air units are used.

[Figure 27] A drawing showing a configuration example of a case in which two or more air units are used.

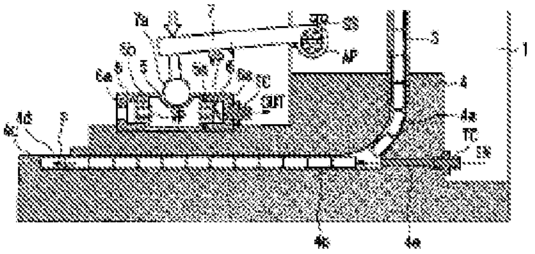
[Explanation of the Reference Numerals]

P: chip components; AN: suction nozzle; 1: frame; 2: hopper; 3: chute tube; 4: component guide; 5: air tank; 6: tank holding member; 7: operation lever; 8: air cylinder; 11: frame; 12: hopper; 13: chute tube; 14: component guide; 15: air tank; 16: tank holding member; 17: operation lever; 18: air cylinder; 21: frame; 22: hopper; 23: chute tube; 24: stirring member; 25: component guide; 26: air tank; 27: tank holding member; 28: component conveying air cylinder; 29: component stirring air cylinder; 30: operation lever; 31, 33: air motors; 34: belt; 35: pulley; 41: component guide; 42, 44: component stoppers; M: magnet; 43, 45: component stopper actuating air cylinders; 46, 47: air cylinders for holding 2nd component; 51: component guide; 52, 53: operation levers

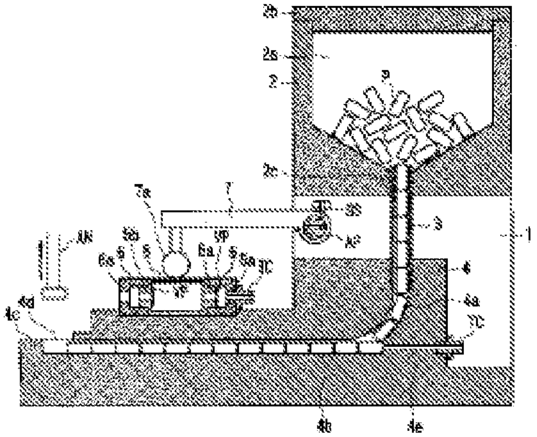
[Figure 2]



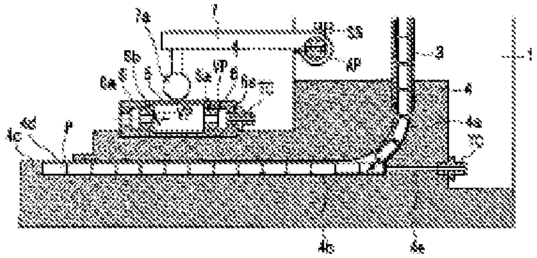
[Figure 3]



[Figure 1]



[Figure 4]



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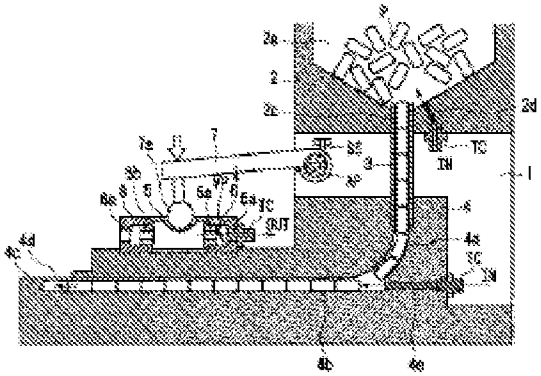
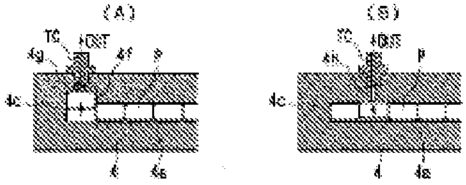
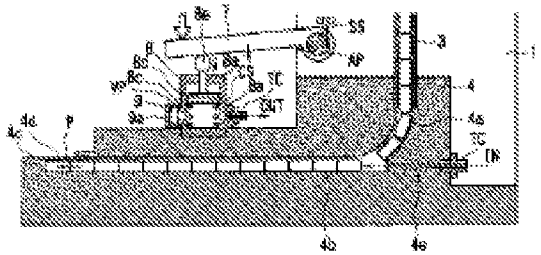


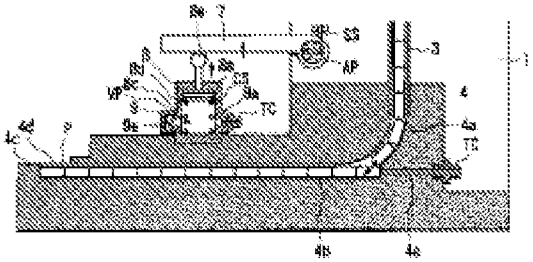
[Figure 6]



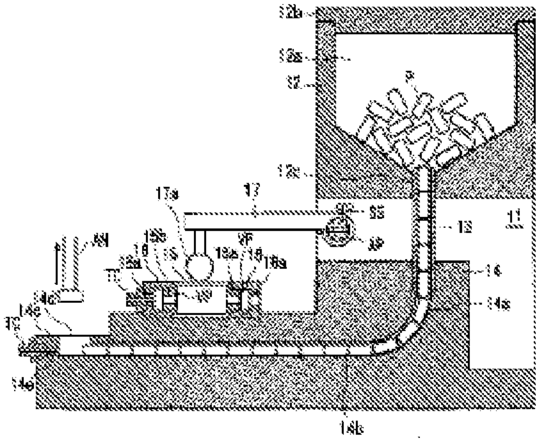
[Figure 7]



[Figure 8]



[Figure 9]



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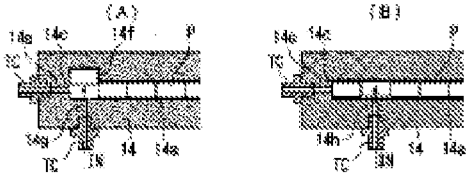

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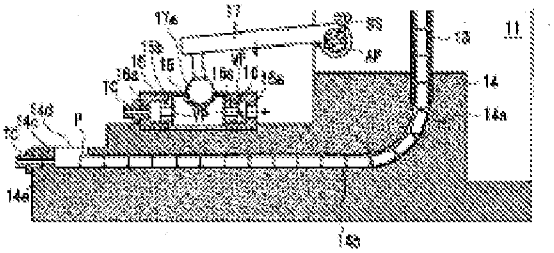

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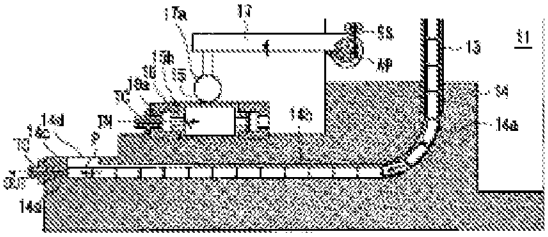

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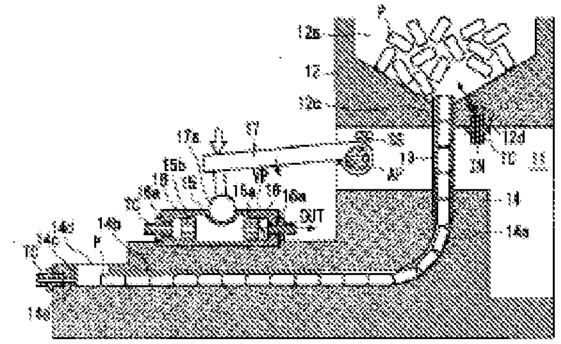

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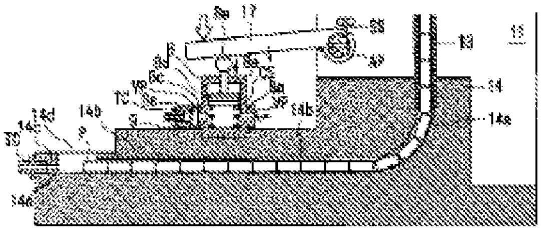

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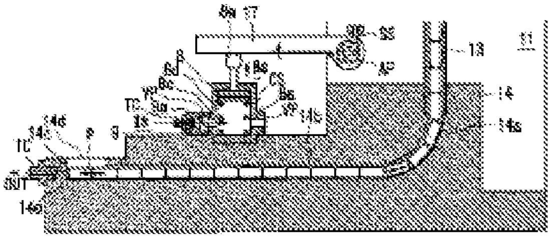

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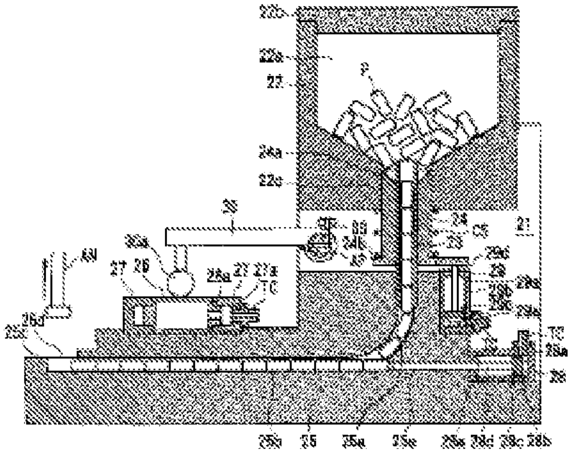

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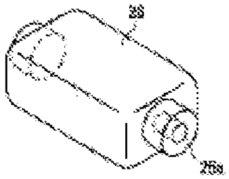

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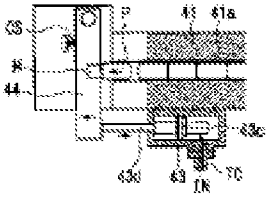

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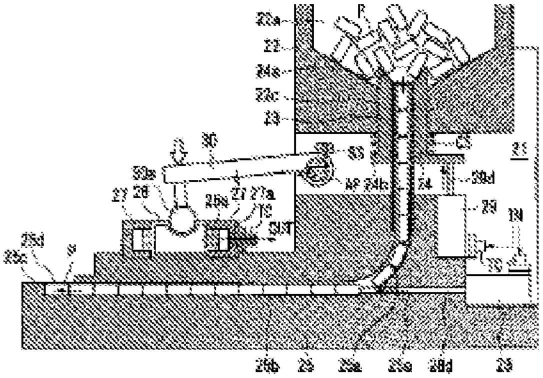

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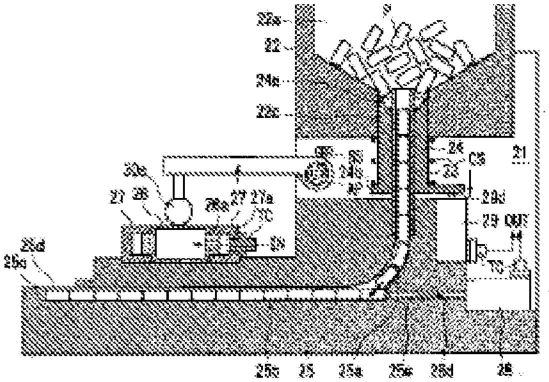

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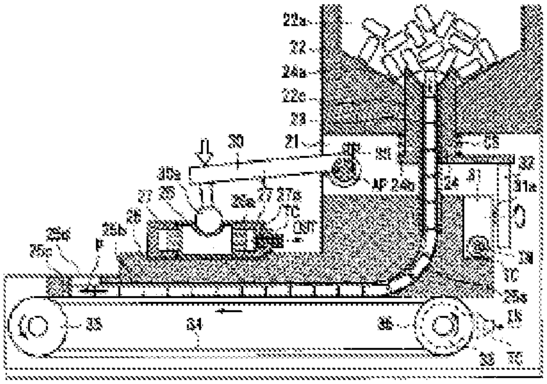

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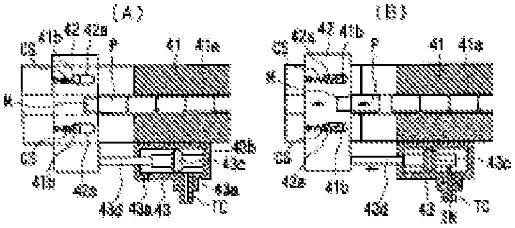

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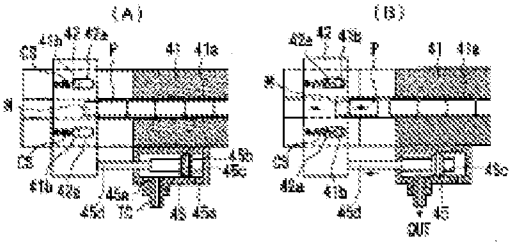

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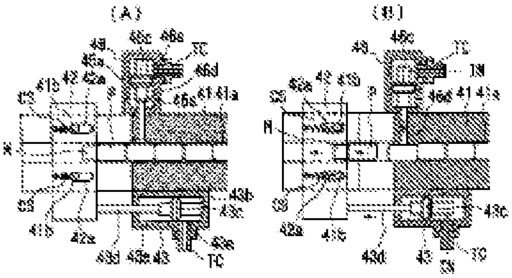

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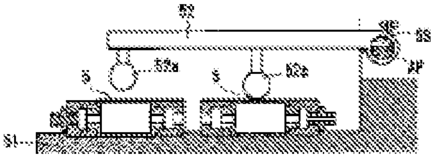
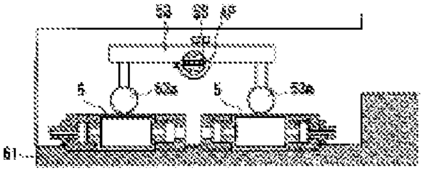


[Figure 27]



[Figure 25]